



MCM6 gene

minichromosome maintenance complex component 6

Normal Function

The *MCM6* gene provides instructions for making part of the MCM complex, a group of proteins that functions as a helicase. Helicases attach to particular regions of DNA and temporarily unwind the two spiral strands of these molecules. When a cell prepares to divide to form two cells, helicases unwind the DNA so that it can be copied. The DNA that makes up the chromosomes is duplicated (replicated) so that each new cell will get a complete set of chromosomes. Helicases are also involved in the production of RNA, a chemical cousin of DNA.

Health Conditions Related to Genetic Changes

lactose intolerance

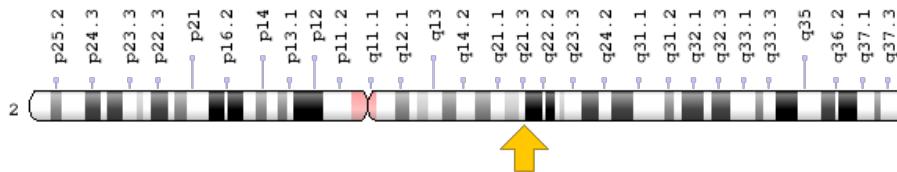
A specific DNA sequence within the *MCM6* gene called a regulatory element helps control the activity (expression) of a nearby gene called *LCT*. The *LCT* gene provides instructions for making an enzyme called lactase. This enzyme helps to digest lactose, a sugar found in milk and other dairy products. Lactose intolerance in adulthood is caused by gradually decreasing expression of the *LCT* gene after infancy, which occurs in most humans.

At least four variations have been identified in the regulatory element that modulates *LCT* gene expression. These variations change single DNA building blocks (nucleotides) in the regulatory element. Each of the variations results in sustained lactase production in the small intestine and the ability to digest lactose throughout life. People without these changes have a reduced ability to digest lactose as they get older, resulting in the signs and symptoms of lactose intolerance.

Chromosomal Location

Cytogenetic Location: 2q21.3, which is the long (q) arm of chromosome 2 at position 21.3

Molecular Location: base pairs 135,839,626 to 135,876,477 on chromosome 2 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- DNA replication licensing factor MCM6
- MCG40308
- MCM6 minichromosome maintenance deficient 6 (MIS5 homolog, *S. pombe*)
- MCM6_HUMAN
- minichromosome maintenance deficient (mis5, *S. pombe*) 6
- minichromosome maintenance deficient 6 homolog
- Mis5
- MIS5 homolog
- P105MCM

Additional Information & Resources

Educational Resources

- Biochemistry (fifth edition, 2002): Many Adults are Intolerant of Milk Because They Are Deficient in Lactase
<https://www.ncbi.nlm.nih.gov/books/NBK22593/#A2242>

Scientific Articles on PubMed

- PubMed
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28MCM6%5BTIAB%5D%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D>

OMIM

- MINICHROMOSOME MAINTENANCE COMPLEX COMPONENT 6
<http://omim.org/entry/601806>

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
http://atlasgeneticsoncology.org/Genes/GC_MCM6.html
- ClinVar
<https://www.ncbi.nlm.nih.gov/clinvar?term=MCM6%5Bgene%5D>
- HGNC Gene Family: MCM family
<http://www.genenames.org/cgi-bin/genefamilies/set/1085>
- HGNC Gene Symbol Report
http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=6949
- NCBI Gene
<https://www.ncbi.nlm.nih.gov/gene/4175>
- UniProt
<http://www.uniprot.org/uniprot/Q14566>

Sources for This Summary

- Enattah NS, Jensen TG, Nielsen M, Lewinski R, Kuokkanen M, Rasinpera H, El-Shanti H, Seo JK, Alifrangis M, Khalil IF, Natah A, Ali A, Natah S, Comas D, Mehdi SQ, Groop L, Vestergaard EM, Imtiaz F, Rashed MS, Meyer B, Troelsen J, Peltonen L. Independent introduction of two lactase-persistence alleles into human populations reflects different history of adaptation to milk culture. *Am J Hum Genet.* 2008 Jan;82(1):57-72. doi: 10.1016/j.ajhg.2007.09.012.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/18179885>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2253962/>
- Ingram CJ, Mulcare CA, Itan Y, Thomas MG, Swallow DM. Lactose digestion and the evolutionary genetics of lactase persistence. *Hum Genet.* 2009 Jan;124(6):579-91. doi: 10.1007/s00439-008-0593-6. Epub 2008 Nov 26.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/19034520>

- Ingram CJ, Raga TO, Tarekegn A, Browning SL, Elamin MF, Bekele E, Thomas MG, Weale ME, Bradman N, Swallow DM. Multiple rare variants as a cause of a common phenotype: several different lactase persistence associated alleles in a single ethnic group. *J Mol Evol*. 2009 Dec;69(6):579-88. doi: 10.1007/s00239-009-9301-y. Epub 2009 Nov 24.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/19937006>
- Itan Y, Jones BL, Ingram CJ, Swallow DM, Thomas MG. A worldwide correlation of lactase persistence phenotype and genotypes. *BMC Evol Biol*. 2010 Feb 9;10:36. doi: 10.1186/1471-2148-10-36.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/20144208>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2834688/>
- Järvelä IE. Molecular genetics of adult-type hypolactasia. *Ann Med*. 2005;37(3):179-85. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/16019716>
- OMIM: MINICHROMOSOME MAINTENANCE COMPLEX COMPONENT 6
<http://omim.org/entry/601806>
- Olds LC, Sibley E. Lactase persistence DNA variant enhances lactase promoter activity in vitro: functional role as a cis regulatory element. *Hum Mol Genet*. 2003 Sep 15;12(18):2333-40. Epub 2003 Jul 22.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/12915462>
- Robayo-Torres CC, Nichols BL. Molecular differentiation of congenital lactase deficiency from adult-type hypolactasia. *Nutr Rev*. 2007 Feb;65(2):95-8. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/17345962>

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